SSM -Population Health 2 (2016) 136–140

Contents lists available at ScienceDirect

SSM -Population Health

journal homepage: www.elsevier.com/locate/ssmph

Article

Influence of volunteer-led net step exercise class on older people's self-rated health in a depopulated town: A longitudinal study

Satoko Showa [a,*], Kazutoshi Kitazawa [b], Miki Takeuchi [a], Mitsuru Mori [a]

[a] Department of Public Health, Sapporo Medical University School of Medicine, S1, W17, Chuo-ku, Sapporo, Hokkaido 060-8556, Japan
[b] Hokkaido University of Education, Kushiro Campus, Hokkaido, Japan

ARTICLE INFO

Article history:
Received 20 October 2015
Received in revised form
25 December 2015
Accepted 6 January 2016

Keywords:
Japan
Depopulated areas
Older people
Health promotion
Physical activity
Social participation

ABSTRACT

In a depopulated region where population aging is advancing, it is necessary to establish a method so local residents themselves can be actively involved in older people's health promotion. Net Step Exercise, a novel dual-task walking program, introduced residents to opportunities for physical activities and social participation without any health specialist support. In one depopulated town (Ikeda, Nakagawa-gun, Hokkaido, Japan), volunteer residents have held Net Step Exercise classes throughout the town since 2007. We longitudinally examined the influence of volunteer-led Net Step Exercise class participation on subsequent self-rated health in all individuals aged 70–79 years living in Ikeda. A total of 662 people who completed a baseline mail-in questionnaire survey in 2012 were followed until 2014. Logistic regression analysis was performed to examine the association with self-rated health after two years of class participation once a month or more at baseline, after controlling for confounds such as age, sex, years of education, living alone, baseline self-rated health, regular exercise, and other physical activities. The odds ratio of poor self-rated health in older people who participated in classes was 0.53 (95% confidence interval [CI]: 0.34–0.85) compared to older people not participating in classes. Even after confounding factors were adjusted, the odds ratio of class participation was 0.50 (95% CI: 0.29–0.85). This study showed that participation in volunteer-led Net Step Exercise might prevent poor self-rated health. Such Net Step Exercise classes are a feasible method for older people's health promotion in depopulated municipalities.

1. Introduction

As of 2010, 44.9% of all municipalities in Japan are witnessing increasing depopulation. According to the 2010 Population Census of Japan, the average aging rate of people older than 65 years old in these depopulated areas is 33.2%, well above the national average aging rate of 22.8%. The aging rate will surpass 40% in 40% of all municipalities nationwide in 2040. In such areas, quality health care services, private facilities, health science authorities, and leaders are limited. There is a need for effective means of health promotion in which local residents themselves can be actively involved.

Promoting physical activity and exercise in older people can be expected to help in improving their functional status, motor ability, mental health, and social function (Taylor et al., 2004) and in preventing mortality from stroke and coronary heart disease (Noda et al., 2005), arthralgia (Heesch, Miller, & Brown, 2007), fracture (Gregg, Cauley, Seeley, Ensrud, & Bauer, 1998), depressive symptoms (Smith et al., 2010), and dementia (Ravaglia et al., 2008). Indeed, older people have been advised to participate in moderate-intensity aerobic activity for at least 150 min per week (Nelson et al., 2007; Elsawy & Higgins, 2010). However, research on older people often reports dropouts in self-training after interventions such as aerobic exercise and strength training (Ansai & Rebelatto, 2015). Therefore, the impact of exercise on individual behavior change is not necessarily large.

To encourage higher and continuing participation in physical activity among older people, it is necessary to consider forms of physical activity that are easy to perform and less physically and mentally burdensome, because physical function declines as people age and older people often suffer from various disabilities. Further, group exercise (Mortazavi et al., 2013) and social participation (e.g., salon and volunteer activities) also improve health in older people (Fujiwara et al., 2009; Honda et al., 2010; Hong & Morrow-Howell,

Abbreviations: CI, Confidence interval; NSE, Net Step Exercise; OR, Odds ratio; SRH, Self-rated health

* Corresponding author. Tel.: +81 11 611 2111x2740; fax: +81 11 641 8101.
E-mail address: satoko.showa@sapmed.ac.jp (S. Showa).

http://dx.doi.org/10.1016/j.ssmph.2016.01.002

2010; Ichida et al., 2013). Therefore, group exercise programs are preferred to promote communication between members.

As a specific method, a dual-task exercise program called Net Step Exercise (NSE) was developed in Hokkaido, Japan. Previous studies about dual-task training suggest an improvement in motor functions such as gait and body-sway balance in older adults who underwent nonmotor cognitive dual-task training (Li et al., 2010). NSE uses a net and features slow and low-impact physical movement and cognitive activity. Kitazawa et al. (2015) reported that an NSE intervention conducted just once a week improved cognitive and gait function. This program is also intended to serve as an opportunity for social participation among older people by promoting group exercise. NSE is quite popular among the elderly in Hokkaido.

Volunteer residents have held NSE classes, especially in one depopulated town (Ikeda, Nakagawa-gun, Hokkaido, Japan). Ikeda is a 371.91 km^2 area located in the central part of Hokkaido. Since 1960, the population has been reduced by half to 7572 people in 2012. It is a typical depopulated area. Although the population aging rate was already high at 27.3% in 2002, it rose to 35.4% in 2012. In Ikeda, approximately 40 residents of neighborhood associations have held NSE classes once or twice in a month throughout Ikeda in over 13 places (including community halls and centers) as volunteer activities with no financial support from the local government or public services. The total number of NSE class sessions in Ikeda averaged 23 times monthly and 280 times annually. In Ikeda, for the five years between 2007 and 2012, the total number of NSE class sessions held was 1383 and the total number of participating residents was 21,026.

The present study aims to identify the longitudinal influence of participation in NSE classes provided by volunteer residents on older people's health status in a depopulated town. While previous studies suggested that NSE improves gait and cognitive function in older people, the longitudinal influence of NSE on older people's subjective health status was unclear. Older persons' own perception of their health, often termed self-rated health (SRH), has increasingly been recognized as a simple but comprehensive measure of global health (Deeg & Kriegsman, 2003). SRH is a known factor for predicting death (Idler & Benyamini, 1997; Ishizaki, Kai, & Imanaka, 2006; Kaplan & Camacho, 1983; Tsuji et al., 1994), functional disability, and distress levels (Farmer & Ferraro, 1997). In addition, physical and social activity inhibits poor SRH (Fujiwara et al., 2009; Ichida et al., 2013; Malmberg, Miilunpalo, Pasanen, Vuori, & Oja, 2005). However, to our knowledge, there are few reports identifying the influence of health promotion activities provided continuously by volunteer residents within a depopulated town. We conducted a longitudinal study among older residents in Ikeda for the two years of 2012 and 2014.

2. Methods

2.1 Sample

In 2011, a preliminary cross-sectional survey was conducted via mailed questionnaire among 1180 older local residents aged 70–79, who were not hospitalized in any institution in Ikeda, Nakagawa-gun, Hokkaido. A total of 921 people (78.1%) responded to the preliminary study. Then, in 2012, 898 people, excluding those who had changed residences (7 individuals), been hospitalized (9 individuals), or died (7 individuals), were sent a follow-up cooperation request form starting from 2012 and a questionnaire. In a cohort consisting of 758 people who provided their consent and responded to the request, follow-ups were conducted in 2014. Before the initiation of the 2014 survey, the following older people were excluded from the analysis: those who had changed residences (6 individuals), died (19 people), those declining the survey due to difficulties completing the questionnaire (19 people), no survey response (52 people). The remainder (662 people; 56.1%) who returned valid responses were included in the analysis.

Informed consent was obtained from each person. This study was approved by the Ethics Committee of Sapporo Medical University (January 24, 2012) and conforms to the provisions of the Declaration of Helsinki (Edinburgh, 2001).

2.2 Measurement of participation in NSE health classes

In surveys of their NSE participation, the following question was posed to the participants at baseline: "In the last year, how many times did you participate in the following activities per month on the average?" The participants chose their response from four options: *never*; *1–2 times monthly*; *3–4 times monthly*; or *at least 5 times monthly*. The response rates for the latter three were as low as 14.5%, 3.8%, and 6.2%, respectively. Therefore, in analysis, the responses were classified into two categories: *never* and *once a month or more*.

2.3 SRH measurement

In an SRH survey, the following question was posed to participants at the times of baseline measurement and follow-up: "Overall, how was your health condition in the past month?" The participants chose their response from the following six options: *extremely good*; *very good*; *good*; *not very good*; *not good*; and *not good at all*. Like previous studies (Borgonovi, 2010; Eriksson & Ng, 2015), the responses were summarized for analysis into two categories: *good SRH* (corresponding to *extremely good*, *very good*, and *good*) or *poor SRH* (corresponding to *not very good*, *not good*, and *not good at all*).

2.4 Potential confounding variables

As potential confounding variables, age, sex, years of education, living alone, baseline SRH, regular exercise, and other physical activities were examined. Age was categorized into three groups: $<$ *74 years old*, *74–76 years old*, and $\geq$ *77 years old*. Years of education were categorized into three groups: $\leq$ *9 years, 10–12 years,* and $\geq$ *13 years*. For regular exercise, the following question was posed to the participants: "Do you exercise regularly two hours a week or more?" The participants responded with *yes* or *no*. For living alone, the following question was posed: "Do you live with anyone?" Participants responded with either *yes* or *no*. For other physical activities, the participants were asked whether they had participated in walking, jogging, and park golf once a week.

2.5 Statistical analysis

There were some missing values in one case, which were then supplemented by median.

Chi-square tests were conducted to examine the baseline characteristics. Then, logistic regression analyses were conducted to determine the influence of NSE participation on subsequent instances of poor SRH. In a multivariate analysis, the data were adjusted for covariates including age, sex, years of education, living alone, baseline SRH, regular exercise, walking, jogging, and park golf. A P value of less than 0.05 was considered statistically significant. All statistical analyses were performed on a personal computer with the statistical package SPSS for Windows (Version 19.0 SPSS Inc. Chicago, IL, USA).

3. Results

In the cohort, 186 people (28.1%) showed poor SRH two years later. For baseline characteristics, the number of NSE class participants was significantly higher among women ($P=0.001$), living alone ($P=0.027$), and people who participated in walking ($P<0.001$), jogging ($P=0.046$), and park golf ($P<0.001$) once a week or more; the individual items showed significant differences. A marginally significant higher number of people regularly exercised two hours a week or more ($P=0.065$). There were no differences in age ($P=0.289$), years of education ($P=0.737$), and baseline SRH ($P=0.713$; Table 1). For variables including NSE class participation, age, sex, years of education, living alone, and baseline SRH, the correlation coefficient was less than 0.4 and no multicollinearity was found.

The crude odds ratio (OR) of participation in the NSE class once a month at baseline against poor SRH two years later was 0.53 (95% CI: 0.34–0.85). The OR after adjusting for age and sex was 0.49 (95% CI: 0.30–0.78). Even after NSE class participation once a month at baseline against poor SRH two years later was adjusted for age, sex, years of education, regular exercise, living alone, and baseline SRH, the OR of NSE class participation was 0.46 (95% CI: 0.27–0.77). Furthermore, even after the data were adjusted for other physical activities (park golf, walking, and jogging), the OR was maintained (OR=0.50, 95% CI: 0.29–0.85; Table 2).

4. Discussion

This study revealed that NSE class participation provided by volunteer Ikeda residents was inversely associated with poor SRH in older people two years after participation. It was expected that the NSE class participants included persons who originally performed regular exercise and had good SRH. For these two items, there were no significant differences in baseline characteristics between NSE class participants and non-participants. No multicollinearity was confirmed by correlation analysis among all variables. With that in mind, although the data were adjusted for baseline SRH, sex, age, years of education, living alone, regular exercise and other physical activities in order to exclude confounding, there were no differences in the results.

The results obtained from our study supported previous study results; there was an association between physical activity and SRH (Malmberg et al., 2005; Cimarras-Otal et al., 2014; Han, Kim, Park, Kang, & Ryu, 2009; Wang et al., 2005). According to Malmberg et al. (2005), in a 10-year follow-up of a cohort aged 19–63 years, the risk of average or poor perceived health was significantly lower in a group who had at least some monthly sport activity compared to those with no sport activity. The results of the longitudinal association with NSE and poor SRH in our study were similar to this report.

The results of our study also suggested a new method for exercise that was inversely associated with poor SRH in older people. As physical activity was associated with poor SRH (Han et al., 2009) in a cross-sectional study among older local residents aged 65 years or older, the group in which vigorous or moderate physical activity was performed three days to five days or more a week, showed fewer cases of poor SRH. In contrast, in our study, poor SRH was significantly less with NSE class participation at least once a month or more.

The differences between these studies seemed to be associated with NSE characteristics. The NSE features characteristics of a dual task exercise with additional cognitive tasks (e.g., learning the steps, paying attention to the net while stepping over it) and walking at a slow pace, unlike aerobic exercise. In the previous study, low-frequency intervention of NSE (once a week) improved cognitive and gait functions in people 73 years or older (Kitazawa et al., 2015). Moreover, NSE requires mutually interactive group participation. The previous cross-sectional study showed the association between NSE participation and low rates of depressive symptoms (Showa, Kitazawa, Takeuchi, & Mori, 2015). Thus, NSE participation might result in favorable mental health effects.

In addition, our study supported the reports of previous studies of significant associations between SRH and social participation by volunteers (Fujiwara et al., 2009; Hong & Morrow-Howell, 2010; Kanamori et al., 2014; Nieminen et al., 2010). We focused on the influence of health promotion activities initiated voluntarily by residents in a depopulated area without support or intervention from such authorities. Thus, it is thought that the present study's result showed a concrete method of health promotion which residents could start and continue, which might be useful for older people's health. To our knowledge, there are few reports identifying longitudinal effects of health promotion activities provided continuously by volunteer residents within a depopulated town.

There are several limitations in this study. First, the one-time assessment of NSE class participation excluded the opportunity to account for later changes in NSE class participation. Second, data on some potential important confounders (income, social network, and social support) were unavailable in this study. According to previous studies, individuals who tend to participate in organizations or group activities have been previously good at social networking and social support and these skills are associated with SRH (Zunzunegui et al., 2004) and mental health (Koizumi et al., 2005). In addition, socio-economic status was potentially antecedent to the relationship between involvement and self-rated health (Veenstra et al., 2005). Therefore, these issues must be considered in future research. Third, because of the short follow-up period of two years, the possibility of causal reversal has not been completely eliminated, although baseline SRH was adjusted as confounding. Finally, since the population parameter was defined as the participants of the 2011 preliminary survey, there were people who did not reply, died, or changed residence before the baseline survey was conducted in 2012; thus, the cohort was limited to 56% of the population. Therefore, its level of representation was reduced and the results might be subject to selection bias. In addition, there might be limitations to how far these results can be generalized, as the entire sample of this study consisted of local residents in a single rural area.

Table 1
Baseline characteristics of the study population by Net Step Exercise (NSE) class participation.

Characteristics	Variables	No NSE participation ($n=525$)		NSE participation ($n=137$)		p-value
		N	%	N	%	
Age group	71–73	174	33.1	37	27.0	0.289
	74–76	173	33.0	45	32.8	
	77–80	178	33.9	55	40.1	
Gender	Women	261	49.7	93	67.9	<0.001
Years of education	$\leq$ 9	287	54.7	80	58.4	0.737
	10–12	171	32.6	41	29.9	
	$\geq$ 13	67	12.8	16	11.7	
Living alone		65	12.4	27	19.7	0.027
SRH[a]	Poor	111	21.1	27	19.7	0.713
Regular exercise[b]	$\geq$2 h	241	45.9	75	54.7	0.065
Walking[c]	$\geq$1	181	34.5	70	51.1	<0.001
Jogging[c]	$\geq$1	65	12.4	26	19.0	0.046
Park golf[c]	$\geq$1	143	27.2	67	48.9	<0.001

[a] SRH: self-rated health.
[b] Hours per week.
[c] Times per week.

Table 2
Odds ratios (ORs) with 95% confidence intervals (CIs) of poor self-rated health (SRH) in follow-up related to net step exercise (NSE) participation in baseline.

Characteristic	Variable	Crude			Model 1			Model 2			Model 3		
		OR	95% CI	*p*-value	OR	95% CI	*p*-value	OR	95% CI	*p*-value	OR	95% CI	*p*-value
NSE per month	None	1.00	reference	1.00	1.00	reference		1.00	reference		1.00	reference	
	≥ 1	0.53	0.34–0.85	0.008	0.49	0.30–0.78	0.003	0.46	0.27–0.77	0.003	0.50	0.29–0.85	0.011
Age	71–73				1.00	reference		1.00	reference		1.00	reference	
	74–76				1.91	1.22–2.97	0.004	1.80	1.10–2.94	0.020	1.81	1.11–2.97	0.018
	77–80				1.84	1.19–2.86	0.006	1.50	0.92–2.45	0.107	1.47	0.90–2.41	0.128
					P for trend = 0.009			P for trend = 0.114			P for trend = 0.136		
Gender	Men				1.00	reference		1.00	reference		1.00	reference	
	Women				1.31	0.92–1.86	0.132	0.89	0.59–1.35	0.580	0.81	0.53–1.24	0.327
Years of education	≤ 9							1.00	reference		1.00	reference	
	10–12							0.50	0.32–0.80	0.003	0.50	0.32–0.79	0.003
	≥ 13							0.77	0.41–1.42	0.396	0.74	0.39–1.37	0.336
								P for trend = 0.078			P for trend = 0.065		
Living alone	No							1.00	reference		1.00	reference	
	Yes							1.54	0.89–2.69	0.126	1.53	0.88–2.69	0.135
Baseline SRH[a]	Good							1.00	reference		1.00	reference	
	Poor							7.99	5.17–12.37	< 0.001	7.73	4.98–12.00	< 0.001
Regular exercise[b]	None							1.00	reference		1.00	reference	
	≥ 2 h							0.97	0.65–1.44	0.877	0.96	0.62–1.49	0.860
Walking[c]	No										1.00	reference	
	≥ 1										1.32	0.86–2.03	0.200
Jogging[c]	No										1.00	reference	
	≥ 1										1.05	0.59–1.85	0.878
Park golf[c]	No										1.00	reference	
	≥ 1										0.58	0.37–0.93	0.023

All indicated variables were used as covariates in each model.

[a] SRH: self-rated health.
[b] Hours per week
[c] Times per week

5. Conclusion

The older people who participated in NSE class once a month or more provided by resident volunteers, compared with class non-participants, had significantly lower risk of poor SRH two years after their participation, even after the data were adjusted for age, sex, years of education, living alone, baseline SRH, regular exercise, and other physical activities. This study showed that participation in volunteer-led NSE classes might prevent poor self-rated health. Such NSE classes are a feasible method for older people's health promotion in depopulated municipalities.

References

Ansai, J. H., & Rebelatto, J. R. (2015). Effect of two physical exercise protocols on cognition and depressive symptoms in oldest-old people: a randomized controlled trial. *Geriatrics and Gerontology International*, *15*, 1127–1134.

Borgonovi, F. (2010). A life-cycle approach to the analysis of the relationship between social capital and health in Britain. *Social Science and Medicine*, *71*, 1927–1934.

Cimarras-Otal, C., Calderón-Larrañaga, A., Poblador-Plou, B., González-Rubio, F., Gimeno-Feliu, L. A., Arjol-Serrano, J. L., & Prados-Torres, A. (2014). Association between physical activity, multimorbidity, self-rated health and functional limitation in the Spanish population. *BMC Public Health*, *14*, 1170.

Deeg, D. J., & Kriegsman, D. M. (2003). Concepts of self-rated health: specifying the gender difference in mortality risk. *Gerontologist*, *43*, 376–386.

Elsawy, B., & Higgins, K. E. (2010). Physical activity guidelines for older adults. *American Family Physician*, *81*, 55–59.

Eriksson, M., & Ng, N. (2015). Changes in access to structural social capital and its influence on self-rated health over time for middle-aged men and women: a longitudinal study from northern Sweden. *Social Science and Medicine*, *130*, 250–258.

Farmer, M. M., & Ferraro, K. (1997). F Distress and perceived health: mechanisms of health decline. *Journal of Health and Social Behavior*, *38*, 298–311.

Fujiwara, Y., Sakuma, N., Ohba, H., Nishi, M., Lee, S., Watanabe, N., & Uchida, H. (2009). REPRINTS: effects of an intergenerational health promotion program for older adults in Japan. *Journal of Intergender Relationships*, *7*, 17–39.

Gregg, E. W., Cauley, J. A., Seeley, D. G., Ensrud, K. E., & Bauer, D. C. (1998). Physical activity and osteoporotic fracture risk in older women. Study of osteoporotic fractures research group. *Annals of Internal Medicine*, *129*, 81–88.

Han, M. A., Kim, K. S., Park, J., Kang, M. G., & Ryu, S. Y. (2009). Association between levels of physical activity and poor self-rated health in Korean adults: the third Korea national health and nutrition examination survey (KNHANES), 2005. *Public Health*, *123*, 665–669.

Heesch, K. C., Miller, Y. D., & Brown, W. J. (2007). Relationship between physical activity and stiff or painful joints in mid-aged women and older women: a 3-year prospective study. *Arthritis Research and Therapy*, *9*, R34.

Honda, H., Ueki, S., Okada, T., Ebata, S., Kasai, T., Takato, J., & Haga, H. (2010). Relationships between participation in community activities and psychosocial and physical health of community-dwelling elderly. *Nihon Koshu Eisei Zasshi*, *57*, 968–976.

Hong, S. I., & Morrow-Howell, N. (2010). Health outcomes of Experience Corps: a high-commitment volunteer program. *Social Science and Medicine*, *71*, 414–420.

Ichida, Y., Hirai, H., Kondo, K., Kawachi, I., Takeda, T., & Endo, H. (2013). Does social participation improve self-rated health in the older population? A quasi-experimental intervention study. *Social Science and Medicine*, *94*, 83–90.

Idler, E. L., & Benyamini, Y. (1997). Self-rated health and mortality: a review of twenty-seven community studies. *Journal of Health and Social Behavior*, *38*, 21–37.

Ishizaki, T., Kai, I., & Imanaka, Y. (2006). Self-rated health and social role as predictors for 6-year total mortality among a non-disabled older Japanese population. *Archives of Gerontology and Geriatrics*, *42*, 91–99.

Kanamori, S., Kai, Y., Aida, J., Kondo, K., Kawachi, I., Hirai, H., & Suzuki, K. (2014). Social participation and the prevention of functional disability in older Japanese: the JAGES cohort study. *PLoS One*, *9*, e99638.

Kaplan, G. A., & Camacho, T. (1983). Perceived health and mortality: a nine-year follow-up of the human population laboratory cohort. *American Journal of Epidemiology*, *117*, 292–304.

Kitazawa, K., Showa, S., Hiraoka, A., Fushiki, Y., Sakauchi, H., & Mori, M. (2015). Effect of a dual-task net-step exercise on cognitive and gait function in older adults. *Journal of Geriatric Physical Therapy*, *38*, 133–140.

Koizumi, Y., Awata, S., Kuriyama, S., Ohmori, K., Hozawa, A., Seki, T., & Tsuji, I. (2005). Association between social support and depression status in the elderly: results of a 1-year community-based prospective cohort study in Japan. *Psychiatry and Clinical Neurosciences*, *59*, 563–569.

Li, K. Z., Roudaia, E., Lussier, M., Bherer, L., Leroux, A., & McKinley, P. A. (2010). Benefits of cognitive dual-task training on balance performance in healthy older adults. *Abbreviation Main Titles*, *65*, 1344–1352.

Malmberg, J., Miilunpalo, S., Pasanen, M., Vuori, I., & Oja, P. (2005). Characteristics of leisure time physical activity associated with risk of decline in perceived health—a 10-year follow-up of middle-aged and elderly men and women. *Preventive Medicine*, *41*, 141–150.

Mortazavi, S. S., Shati, M., Ardebili, H. E., Mohammad, K., Beni, R. D., & Keshteli, A. H. (2013). Comparing the effects of group and home-based physical activity on mental health in the elderly. *Internatinal Journal of Preventive Medicine*, *4*, 1282–1289.

Nelson, M. E., Rejeski, W. J., Blair, S. N., Duncan, P. W., Judge, J. O., King, A. C., Macera, C. A., & Castaneda-Sceppa, C. (2007). Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports and Exercise*, *39*, 1435–1445.

Nieminen, T., Martelin, T., Koskinen, S., Aro, H., Alanen, E., & Hyyppä, M. T. (2010). Social capital as a determinant of self-rated health and psychological well-being. *International Journal of Public Health*, *55*, 531–542.

Noda, H., Iso, H., Toyoshima, H., Date, C., Yamamoto, A., Kikuchi, S., …, & JACC Study Group (2005). Walking and sports participation and mortality from coronary heart disease and stroke. *Journal of the American College of Cardiology*, *46*, 1761–1767.

Ravaglia, G., Forti, P., Lucicesare, A., Pisacane, N., Rietti, E., Bianchin, M., & Dalmonte, E. (2008). Physical activity and dementia risk in the elderly: findings from a prospective Italian study. *Neurology*, *70*, 1786–1794.

Showa, S., Kitazawa, K., Takeuchi, M., & Mori, M. (2015). Net-step exercise and depressive symptoms among the community-dwelling elderly in Japan. *The Sapporo Medical Journal*, *84*, 19–26.

Smith, T. L., Masaki, K. H., Fong, K., Abbott, R. D., Ross, G. W., Petrovitch, H., & White, L. R. (2010). Effect of walking distance on 8-year incident depressive symptoms in elderly men with and without chronic disease: the Honolulu-Asia aging study. *Journal of the American Geriatrics Society*, *58*, 1447–1452.

Taylor, A. H., Cable, N. T., Faulkner, G., Hillsdon, M., Narici, M., & Van Der Bij, A. K. (2004). Physical activity and older adults: a review of health benefits and the effectiveness of interventions. *Journal of Sports Sciences*, *22*, 703–725.

Tsuji, I., Minami, Y., Keyl, P. M., Hisamichi, S., Asano, H., Sato, M., & Shinoda, K. (1994). The predictive power of self-rated health, activities of daily living, and ambulatory activity for cause-specific mortality among the elderly: a three-year follow-up in urban Japan. *Journal of the American Geriatrics Society*, *42*, 153–156.

Veenstra, G., Luginaah, I., Wakefield, S., Birch, S., Eyles, J., & Elliott, S. (2005). Who you know, where you live: social capital, neighbourhood and health. *Social Science and Medicine*, *60*, 2799–2818.

Wang, N., Iwasaki, M., Otani, T., Hayashi, R., Miyazaki, H., Xiao, L., & Sakamaki, T. (2005). Perceived health as related to income, socio-economic status, lifestyle, and social support factors in a middle-aged Japanese. *Journal of Epidemiology*, *15*, 155–162.

Zunzunegui, M. V., Koné, A., Johri, M., Béland, F., Wolfson, C., & Bergman, H. (2004). Social networks and self-rated health in two French-speaking Canadian community dwelling populations over 65. *Social Science and Medicine*, *58*, 2069–2081.